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GMSEC Headl i nes

GMSEC Officially Closes out a Successful FY03

Key Milestone met on September 30, 2003, the GMSEC project closed its books for all FY03 work. Besides funding the critical Infrastructure needs of the GMSEC, security, flight software and flight dynamics laboratories, the GMSEC project funded 25 Mission Services Upgrades and Technology Infusion tasks. The following summarizes the highlights from those tasks:

Integrate ITOS with GMSEC

Architecture: Integrated ITOS with the GMSEC software bus so it can send and receive directive messages, send log messages, receive telemetry messages containing CCSDS frames or packets, and send telemetry messages containing data point values. Also, this task was instrumental in assisting in the formulation of GMSEC messages and helped to define the GMSEC API (Applications Programming Interface).

Alternate Scripting Language:

Investigated alternate scripting languages and produced software which enables scripts written in Python to access the full GMSEC API and bus architecture.

OMG-XML Investigation: Examined an XML Schema for defining spacecraft database information. The schema was developed by the Object Management Group's (OMG) Space Domain Working Group. (Note: Considerable work remains before it can be used by ITOS or ASIST.)

GMSEC Automated Quality Assurance for TRMM Reengineering/Flight Dynamics

Automation: Implemented a prototype for the quality assurance component of

AutoFDS, which was instrumental in performing acceptance testing of the AutoFDS generated products for TRMM with the operation products from the FDF.

Autonomous Navigation and Formation

Flying: Delivered new releases of the GEONS flight-quality onboard orbit determination software, including capabilities such as relative state vector estimation for ground station uplink Doppler, celestial object, and point solution measurements, singly-differenced GPS carrier phase measurement processing, which improves relative navigation accuracy to 10 cm level, and Lambert-type maneuver targeting algorithms, which extend GEONS to support formation control.

AMPS/GMSEC Compliancy: Modified AMPS software to monitor the GMSEC software bus to listen for and respond to GMSEC messages; incorporated GMSEC software bus framework into AMPS architecture to monitor software bus; and, successfully created an interface to develop and test the messaging exchange between AMPS and AutoFDS.

The GSFC Mission Services Evolution Center (GMSEC) is a coordinated effort across multiple NASA GSFC development organizations to provide data systems and services to NASA's Earth and Space Science Enterprise missions. Key to the GMSEC concept is its reference architecture designed to reduce system integration costs, increase system capability, and simplify technology infusion over time.

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Importance of Demos

- Show tangible progress to those planning to use the GMSEC concept
- Explain GMSEC to a wider audience
- Baseline the development effort
- Recognize the efforts of the many GMSEC civil servants and contractors
- Solicit critique and new ideas
- Prompt design and ops concept discussion

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GMSEC "Headlines" is prepared monthly to highlight key GMSEC accomplishments or areas of progress and interest. Current and past issues of Headlines are available on-line at gmsec.gsfc.nasa.gov.



GMSEC Headlines (Continued)

GMSEC Simulator Support (DSIM/SIMSS):

Established communications between the Dynamic Simulator (DSIM) and the Scalable Integrated Multi-Mission Simulation Suite (SIMSS) first through socket connections and subsequently through the GMSEC middleware API; successfully supported the production of a vendor-neutral GMSEC API enabling five demonstrations showcasing the level of GMSEC interoperability to various internal and external recipients.

Ethernet/IP Prototyping: Prototyped an onboard, commercially compatible IP-based high-speed network, using a GSFC GOTS Network Interface Card (NIC - commercial port) and a commercial switch, in a heritage flight software environment.

GMSEC Reusable Events Analysis Toolkit (GREAT):

Developed a flexible, highly portable, and comprehensive set of mission operations analysis tools for event/log messages that provide real-time message display, message archive & retrieval, occurrence-triggered actions, and data file format conversion

Security Survey: Completed brief investigation of web tools and continued work on White Paper document linking "IP in Space" practices to GMSEC security.

Advanced Mission Design: Implemented innovative orbit designs using dynamical systems applications that yielded accurate and cost effective methods to construct new libration trajectories, lunar gateways, and unique orbits; provided educational outreach through the Graduate Student Research Program (GSRP) (low thrust trajectory optimization by the University of Texas).

Advanced Attitude: Developed, tested, and delivered an automated gyro calibration algorithm to the operational multi-mission ground attitude system; developed and implemented an automated OBC attitude validation and automated magnetometer calibration utility for the TRMM mission with the goal of implementing it into other ground systems; developed and delivered a more accurate star pattern match utility to the operational multi-mission ground attitude system

Formation Flying Tools Development: Developed a trajectory optimization tool that can be interfaced to existing mission analysis systems; developed a prototype next-generation mission analysis system. This prototype has been used as the model for the Goddard Mission Analysis Tool (GMAT) which is the next generation mission analysis software currently being developed in-house.

Instrument Remote Control (IRC): Used IRC operationally to control the Caltech Submillimeter Observatory and SHARC instrument resulting in over 4000 observations in FY03; delivered a Graphical User Interface customization component that can dynamically create a custom user interface from an XML description

Advanced Solid State Recorder (SSR) SchEduling Tool (ASSET):

Enhanced made to provide better SSR management support for the Terra spacecraft. Enhancements included: an interface with the Terra planning and scheduling system to obtain scheduling reports automatically, GUI improvements for easier use by the engineer, increased flexibility to handle overlapping Ground contacts, a new feature for displaying snapshots of SSR buffer usage, and accounting for playback offsets in the buffer usage calculation algorithm. (Note: This tool has greatly reduced both time and effort with the Flight Operations Engineer managing the Terra SSR buffers.)

Science Data Processing System Interface and

Architecture: Researched the concept of separate science and engineering data streams and its implications for science data processing, flight operations and instrument control; identified several existing and potential data dependencies between the science data processing systems and other flight/instrument operations systems

Fall Demo Planned

The next demonstration scheduled for October/November will include standard messages for telemetry frames, data value requests and data value distribution. Also, Java Messaging Service will be used to provide an open source alternative for the middleware. Additional components including attitude determination and data analysis tools will be added. Finally, additional languages for the API will be supported including Perl, MatLab and Python.

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Past Issues of GMSEC Headlines

July 2003: "COTS Vendors Supporting GSFC Ground System Efforts"

GMSEC Headlines (Continued)

GMSEC Takes on New Challenges for FY04

During September 2003, the GMSEC project began its transition from FY03 to FY04. The project announced the approved proposals for FY04—these were the proposals that were part of the annual GMSEC proposal call initiated in June 2003. Besides the continual need to fund critical infrastructure needs, 31 individual proposals will be funded to provide needed mission upgrades and technology infusion. The following lists these new proposals by Branch for FY04:

Code 581:

MMS Engineering - Overall Coord.
SMEX Reengineering - Overall Coord.
Neural Net Continuation
ISR Modeling Effort

CODE 582:

Common Flight Exec for Plug and Play
On-Board Networking
GMSEC Compliant FSW Simulator

CODE 583:

SLE on SOHO
GMSEC Middleware Comparison and Benchmarking Study
Simulator and Demo Support - Low Fidelity
GPM, SOHO, WIND/POLAR Trending
GMSEC Reusable Trending, Analysis & Plotting System (TAPS)
Integrate Existing FD Tools to Enhance Automated Product Generation/Distribution
STK/Scheduler with WIRE
Adding Autonomous Maneuver Planning Capability to the Formation Flying Testbed
GMSEC Reusable Events Analysis Tool (GREAT)
P/S Strategic Direction Coord. (w/ Ames, others) includes AMPS & MOPSS support

CODE 584:

Integrating ASIST and ITOS into GMSEC Environment
Eclipse Consulting, GMSEC Compliance
L3-STORM Consulting, GMSEC Compliance
Front-End Processor in Lab
Common Mission Database

CODE 585:

Security Improvements

CODE 588:

Automation/Autonomy

Web Services, PORTAL, data access Work

Paging/alert system

TRMM Reengineering

CODE 595:

Flight Dynamics Tools and Models Maintenance

Mission Formulation Support

Advanced Attitude Determination, Cal. & Modeling

Advanced Mission Design

Standardizing Flight Dynamics Data with XML, Standardizing Execution of Flight Dynamics Applications

GEONS Ground Support System

Simulator and Demo Support - Med Fidelity

GMSEC Supports TRMM and SMEX Re-engineering Efforts

During FY04, the GMSEC project will be involved with two key re-engineering efforts: (1) the TRMM control center will be upgraded for Code Y; (2) the remaining SMEX missions will be “consolidated” and operated as a fleet for Code S. Both initiatives will rely on the GMSEC architecture and framework in order to achieve their immediate as well as long term goals. For example, the TRMM effort will employ several automated features that will be a precursor for on-going missions like Terra and Aqua, and eventually Aura. Likewise, we anticipate that the SMEX effort will pave the way for future constellation missions like MMS.

GMSEC In-House Team Formed

New this year is the formation of an in-house GMSEC technical team comprised of civil servants from the Information Systems Division (ISD). The purpose of this team is to foster the development of key technical competencies within the ISD while at the same time contributing to the overall technical goals and objectives of the GMSEC project. One of the main focus areas will be the potential for web services within the GMSEC architecture.

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